Image Crisis

Inspiring a New Generation of Computer Scientists

Consider what you can do to encourage young people to pursue technology-related career paths.

IS COMPUTER SCIENCE a dying profession? That may seem like an odd question. After all, computers are omnipresent in our day-to-day lives. Their importance to the way we run our businesses, communicate, and use information has never been greater. Computing is an essential tool for discovery and advancement in virtually every field of science. And as we move forward, computing holds the key to progress in almost every human endeavor.

And yet the fact remains that, in the U.S. at least, computer science as a profession is beginning to wither away.

There is ample evidence to support this conclusion. A recent UCLA survey found that in 2006, barely 1% of incoming freshman planned to major in computer science, compared with nearly 5% 25 years ago. According to the most recent version of the Computer Research Association's annual Taulbee report, just 12,498 computer science and computer engineering degrees were awarded last year, a one-year drop of almost 20%. Even more alarming, total undergraduate enrollment in computer science and computer engineering has fallen 50% during the past five years, to just 46,000 students.

All this comes at a time when demand for computer scientists is stronger than it has been for many years. Today, IT employment is 17% higher than it was at the height of the dot-com bubble. According to the U.S.

Bureau of Labor Statistics, we will add an annual average of 100,000 new computer-related jobs through 2014, with careers in computer science the fastest-growing of all "professional and related occupations."

These numbers actually understate the severity of the problem. Enrollment in computer science and computer engineering programs in the U.S. consists of a disproportionate number of foreign-born students, particularly at the graduate level: last year, more than half of master's and doctoral degrees granted by U.S. universities were awarded to non-U.S. citizens. Thanks to a combination of security restrictions here and increasing job opportunities in their home countries, fewer numbers of these students are choosing to remain in the U.S. to work.

Left unchecked, these trends will inevitably undermine our ability to compete in the global economy. For decades, the ability of U.S. companies to transform innovations into successful businesses has been the foundation for our economic growth. Technologies such as the microprocessor, the Internet, and fiber optics that were developed by scientists and engineers trained in U.S. universities laid the foundation for new industries that generated millions of high-paying jobs.

But if the number of young people in the U.S. who study computer science continues to decline, the center of gravity for innovation will shift to countries where students flock to uni-

versities to pursue degrees in the technical fields that will enable tomorrow's breakthroughs.

As head of Microsoft Research, I am acutely aware of the impact that the shortage of computer professionals can have. Although the majority of our researchers are based in the U.S. and these facilities continue to grow, we are expanding our research facilities in other parts of the world, in part because we recognize that this may be the only way we can continue to find and hire the world's top computer scientists. I also see the increasing difficulty that Microsoft has in filling positions that require a high level of training and skill in computer science and engineering.

And, as co-chair of the Image of Computing Task Force with Jim Foley of Georgia Tech, I am committed to working with colleagues from industry, academia, and government to understand why interest in computer science is declining in the U.S. and learn what we can do to encourage young people to pursue technology-related careers. Founded by Foley, and based at the University of Colorado in Boulder, the Image of Computing Task Force is spearheading a national effort to help young people recognize the vital role that computing plays in almost every field and see the opportunities that come with a solid background in computer science.

Through my work with Jill Ross, director of the Image of Computing Task Force, I've spoken with high school

and college students from across the country. What I've learned from these conversations and from the growing body of research into why students are losing interest in computing gives me hope that we can inspire a new generation of bright young people to pursue careers in computer science and related fields. At the heart of falling interest in computer science are fundamental misconceptions about the work we do, our ability to make a difference in the world, and the job opportunities our field offers. If we can change these perceptions, we can ensure that instead of withering, our profession will thrive.

One barrier to interest in computer science is the unfortunate and deeply held stereotype of the solitary male programmer who slaves over a keyboard and subsists on snack food. A majority of young people subscribe to this stereotype and believe the job of the computer scientist consists of endless days spent alone in front of a computer screen. A survey of high school students enrolled in calculus and pre-calculus courses—students likely to have an aptitude for computer science—found that half have already decided not to pursue computer science as a major because they don't want to “sit in front of a computer all day.”

The problem is even more acute among women. A study of college undergraduate women who had achieved high SAT scores found that 70%–80% of them chose not to major in computer science and computer engineering because they felt they “would not enjoy the work.” Young people also underestimate the role that computing can play in changing the world. To most high school and college students, the job of the computer scientist is simply to write code. What they don't understand is that most of us chose to write code because we understood the power of computing as a tool for tackling important problems.

A study that compared computer science graduates at Georgia Institute of Technology with students who switched from computer science to another major is instructive. In that study, a typical graduate student who stayed in the major defined computing as “creating the applications...that allow computers to solve real-world problems.” Students who left the ma-

jor saw it as an exercise in “learning how to manipulate code,” and they assumed their work experience would be “boring...debugging code in front of a computer screen all day.”

Finally, the post-dot-com downturn notion that there aren't many openings in the field persists, compounded by the belief that computer-related jobs are quickly being outsourced. The message that many students hear from parents and teachers is that computer science is not a good career choice, despite U.S. Bureau of Labor Statistics reports indicating it is one of this country's fastest-growing professions.

Last February, I met with a number of high school and college students who are deeply interested in computer science. My goal was to learn what inspired them and find out what they think we can do to help inspire their peers. Part of what I learned was the important role an adult—a good teacher or an interested mentor—can play in encouraging an interest in computing.

One such student is Evie Powell, a Ph.D. candidate in game design at the University of North Carolina at Charlotte. From a family that discouraged her love of math and computers, she struggled as an undergraduate until she took an introductory game development course. “This class and its professor turned out to be the inspiration I needed,” she said.

Today, Evie is also active in the STARS Alliance, a program that aims to increase participation by women and minorities in computing. “I hope to reach out to those who feel like they don't have a place in such a technical field of study,” she said. “And hopefully show them early on that they too...have much to offer to the discipline.”

I also met UNC Charlotte student Lane Harrison. He started college with a vague interest in computing but felt he lacked the background and confidence to succeed. Now a third-year computer science and mathematics major, he says exceptional teaching was the catalyst for his decision to pursue computing. He too is active in the STARS Alliance and has spoken to more than 1,000 high school students about his enthusiasm for computing.

I was thrilled by the passion for computing that Evie, Lane, and the other students I met with share. I also came away

from those meetings feeling that those of us already in the field should see the work they are doing to encourage other young people as a personal challenge.

As ACM members, shouldn't we be even more committed to spending time out in the community and sharing our enthusiasm for computing than Evie and Lane are? Isn't it really up to us to show the next generation of potential computer scientists how exciting it is to work in a field where we have the opportunity to advance science, cure diseases, and tackle global warming? Shouldn't we be the ones out there demonstrating that our work consists less of debugging code than it does of collaborating with colleagues to develop new ideas and create solutions to difficult challenges?

How can we do this? By visiting schools and community groups to share our passion for our field and to make clear that a career in computing is filled with great jobs and incredible opportunities. By bringing young people to the places where we work so they can see what we really do. We can do it by offering internships and taking the time to mentor a young person and encourage their interest in math, science, and computing.

We also need to reach out to the people who have the greatest influence on young people: parents, teachers, counselors, and the media. Talk with teachers and professors and encourage them to show their students not only how to write code, but why computing is such a powerful way to solve problems.

Speak with parents or guidance counselors and make clear to them that computing is a career path that offers high-paying job opportunities unmatched by almost any other profession. Talk to journalists and emphasize the importance of computing as a driver for innovation and progress, and encourage them to provide a realistic picture of the work we do that goes beyond the traditional stereotype of the geek programmer.

If you are like me, you entered this field to make a difference. This is your opportunity. The future of our profession depends on it.

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